PATENT SPECIFICATION (11) 1 537 714

(21) Application No. 15728/76 (22) Filed 15 April 1976 (19)

(31) Convention Application No. 2 517 000

(32) Filed 17 April 1975 in

(33) Fed. Rep. of Germany (DE)

(44) Complete Specification published 10 Jan. 1979

(51) INT. CL.[2] B65H 45/16 35/08 45/22

(52) Index at acceptance

B8R 11B 11D 4B

1 537 714

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(54) MULTIPURPOSE WEB FOLDING AND CUTTING ARRANGEMENT

(71) We, MASCHINENFABRIK AUGSBURG-NÜRNBERG AKTIENGESELLSCHAFT, a German company, of 8900 Augsburg, Stadtbachstrasse 1, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a multipurpose web folding and cutting arrangement for producing printed sheets or page sections (signatures), e.g. cross-folded and/or longitudinally folded products for books and covers.

Folders are known in which a full or half-width paper web is longitudinally folded via a feeder folding former and the web is then cut once or twice on the periphery of a folding cylinder and by having a first cross-fold made in the resulting sheets the signatures are delivered with a sheet depth of a half or a quarter of the circumference of the plate cylinder. The sheet depth can be halved again with a second cross-fold, so that the height of the delivered product is 1/4 or 1/8 of the plate cylinder circumference. For pamphlets and journals, the web may be folded longitudinally once more after the first cross-fold, producing a format of half or a quarter size and half the page depth of that produced from the paper width produced after the feeder fold.

It is also possible, on the other hand, to split up the cut sheet length to a format height of one third the size by means of two cross-folds.

For book section printing, folders of this type are less suitable because in cross-folding the grain flow of the paper is at right angles to the backs of the folds and the risk of producing calender creases (wrinkles) on a following longitudinal fold is too great.

The object of the invention is to provide apparatus for producing a variety of different folded and cut printed web products, for example book sections and covers folded only longitudinally, using standard folder components for longitudinally and transversely folded products.

According to the present invention, there is provided a multipurpose web folding and cutting arrangement for producing printed sheets or page sections (signatures) from a printed web, the arrangement comprising a feeder folding former for folding a continuous web longitudinally, a first transverse folding cylinder and a transverse cutting cylinder cooperating therewith, arranged to receive a longitudinally folded web from the folding former and adapted to cut the web transversely, the transverse cutting cylinder being adapted so that its cutting means can be rendered inoperative, the first folding cylinder having means on its periphery for transferring cut sheets or page sections around with it as it rotates, a second transverse folding cylinder arranged to receive sheets or page sections from the first folding cylinder, a further longitudinal folder for folding sheets or page sections longitudinally and arranged for receiving sheet or page sections from the second folding cylinder, and an additional cylinder which is provided with means on its periphery for transversely cutting a web and/or collecting sheets and which is arranged for cooperation with the first folding cylinder.

This provision means, with small editions especially, that a versatile folding operation can be run off separately, such as, for example, a second longitudinal fold or a magazine fold for 2 × 8 or 2 × 4 pages or 4 × 4 pages without there being the necessity of incurring the extra expense of providing additional equipment. Furthermore, the running costs can be reduced because the change-over from one type of production to another is quick and simple to put into practice.

According to a preferred form of construction, the additional cylinder equipped for cutting and collecting has three cutting knives and three collector means, for example three rows of spiking pins, circumferentially staggered by 120°, and the additional cylinder is preferably disposed below the first folding cylinder (folding knife cylin-

der). This means that signatures of 2 × 4 or 2 × 8 pages with a magazine fold, i.e. one longitudinal fold only, can be brought to a delivery direct without the products needing to run through the cross folders or second longitudinal folder.

In order to run normal production with one cross-fold, according to an expedient development, the first folding cylinder is provided with four equally circumferentially spaced cutting grooves adapted to cooperate with cutting knives on the adjacent cutting cylinders. Two of the cutting grooves, which lie diametrically opposite each other, may each have a folding knife bar disposed adjacent thereto such that either the knife bars or the cutting grooves may be operative; alternataively the two cutting grooves may be provided on a folding knife bar carried by the first folding cylinder.

To convey the products, which are folded longitudinally once and are to be provided with a second longitudinal fold, from the folding knife cylinder to the second folding cylinder (folding gripper cylinder), the latter is conveniently provided with two rows of diametrically oppositely disposed spiking pins staggered respectively by 90° to two diametrically oppositely disposed folding blades.

The invention may be carried into practice in a number of ways but one specific embodiment will now be described, by way of example only, with reference to the accompanying drawing, in which:—

Figure 1 shows diagrammatically a web folding and cutting arrangement in accordance with the invention, and

Figures 2, 3 and 4 show diagrammatically examples of different products which may be produced using the arrangement shown in Figure 1.

The folding and cutting arrangement consists of one or two feeders including longitudinal folding formers 1 or 2, feeder rollers 3, 4 or 5, 6 and a number of feed rollers designated generally by 7 which convey a paper web 8 and, when required, a second web 9 between a cutting cylinder 10 and a folding knife cylinder 11. The cutting cylinder 10 is provided with a cutting knife, not designated, which normally cooperates with two, i.e. two alternate ones, of four cutting grooves 12 distributed evenly on the circumference of the folding knife cylinder 11 and which cuts the paper webs 8, 9 to a predetermined sheet length i.e. a length in the longitudinal direction equal to the circumference of the cutting cylinder 10.

The leading edges of the cut sheets, folded once longitudinally on the feeder former(s) 1, (2), are pierced by rows of spiking pins 13, 14, on the folding knife cylinder 11 and are thereby conveyed further in the direction of rotation of the cylinder 11, indicated by the arrow, and by means of folding knives 15, 16 on the cylinder 11, which cooperate with folding grippers 17, 18 disposed diametrically opposite each other on a folding gripper cylinder 19, are provided with a cross-fold. If required, each sheet product, i.e. signature, may be provided with a second cross-fold by a further folding knife cylinder 20 and be brought to delivery via a vane wheel 21 and continuous belts 22, 23. A further possibility lies in conveying each signature after the first cross-fold on the folding gripper cylinder 19 between the conveyor belts 24, 25 to a second longitudinal folder 26 and from there to bring them to delivery via a further vane wheel 27 and a continuous conveyor belt 28, the signatures being provided with two longitudinal folds and one cross-fold. For this the folding knife cylinder 20 has grippers 38 as well as the folding knife and the folding gripper cylinder 19 in addition has folding grippers 39, 40.

In order to be able to produce signatures provided with only two longitudinal folds, there is coordinated with the folding knife cylinder 11 an additional cylinder 30, equipped with both cutting and collecting means; the diameter of the additional cylinder 30 is equal to 3/4 of that of the folding gripper cylinder 19 and around its periphery it is provided with three cutting blades 31 staggered circumferentially by 120° with rows of spiking pins 32 disposed adjacent and behind them relative to the running direction, i.e. direction of rotation, of the cylinder, to enable the paper web to be cut twice on the cylinder periphery. The cylinder 30 is disposed below the folding knife cylinder 11 so that delivery can be made direct on to the conveyor belts 33, 34, as will be described later. The additional cylinder 30 may be mounted so as to rotate in a fixed location relative to the folding knife cylinder 11, or it may be mounted so as to be bodily movable between an operative position adjacent the folding knife cylinder 11 and a non-operative position spaced from the folding knife cylinder 11.

In order to enable production to run via the cylinder 30, the cutting knife is removed from the cutting cylinder 10 and the web folded longitudinally via the feeder former 1 (and if required, a further web folded by the former 2) is cut to format height (sheet length) by means of the successive cutting knives 31, each of which cooperates with one of the cutting grooves 12 on the folding knife cylinder 11. The two cutting grooves 12 adjacent the folding knives 15, 16 may be provided in the cylinder or the knife bars may be provided both with cutting grooves and folding knives adjacent to one another, so that exchanging them becomes unnecessary. Alternate sheets or sheet sections cut by

each cutting blade 31 are guided round the cylinder by the spiking pins 32 on the cylinder 30 and at the cutting point 35 those alternate sheets or sheet sections are superposed onto the following sheet or sheet section, both sheets or sheet sections being picked up by the spiking pins 13 or 14 of the folding knife cylinder 11, with the result that the two sheets or sheet sections, folded longitudinally by the feeder former, arrive one on top of the other at the folding gripper cylinder 19, whose folding grippers 17 and 18 are put out of action for this type of production, as are the folding knives 15, 16 on the folding knife cylinder 11; at the cylinder 19, the sheets or sheet sections are pierced by spikes 36, 37 disposed on the folding gripper cylinder 19, which spikes are staggered by 90° relative to the folding grippers 17, 18. By means of the conveyor belts 24, 25, the superposed sheets or sheet sections are conveyed from the folding gripper cylinder 19 to the further longitudinal folder 26, resulting in sixteen-page signatures, or book sections, open on three edges, as shown in Figure 2.

The longitudinal folder 26 consists of a rotating folding knife, cooperating with two folding rollers in known manner and is therefore not described in further detail. The one set of longitudinal edges of the signatures originating from the first longitudinal fold are cut after binding.

Expediently coordinated with the folding knife cylinder 11 in the running direction after the cylinder 30, i.e. between the additional cylinder 30 and the folding gripper cylinder 19 relative to the direction of rotation of the cylinder 11, is a longitudinal perforation device 29 which serves to perforate the collected sheets thereby to prevent displacement from one another of the layers of paper, open on three edges. The height of the format of the signatures, or book sections, shown in Figure 2 is 1/2 the circumference of the plate cylinder = impression plate length, and the width of the format is 1/4 the paper web width arriving at the feeder 1. Naturally by using webs of full width instead of half width, as described, and by cutting longitudinally before the feeder former, and superposing one half on to the other, signatures of thirty-two pages may be produced in this manner, by conveying two sheets respectively from the cylinder 30 during cutting and by superposing the two sheets onto two more sheets on the folding knife cylinder 11, with the result that four sheets, folded longitudinally once, are conveyed to the longitudinal folder 26.

To produce four-page signatures or covers, the web or webs 8, 9 are similarly cut with the cutting knives 31 in cooperation with the cutting grooves at the cutting point 35, but they are not collected via the cylinder 30 but are conveyed further by means of the rows of spiking pins 32 on the cylinder 30 on to the conveyor belts 33, 34. The rows of spiking pins 13, 14 on the folding knife cylinder 11 in this case are put out of action, as are, in both the last described cases, the folding knives 15 and 16.

The processing of a web of half width gives rise to products shown in Figure 3, i.e. four-page covers in continuous succession. If a web of full width is guided via the feeder folder, cut and folded over, eight-page covers may be produced, as Figure 4 shows, likewise in continuous succession.

Depending on how many webs and which feeder formers are used, a great variety of different products may be made, e.g. products with 2 × 4 page sections with a full width web folded in half longitudinally by a feeder former; by means of an additional feeder former for producing half width webs from a web of full width, 4 × 4 page sections, cut longitudinally in the centre, may be delivered separately; for signatures with 2 × 8 pages, the web of full width has to be cut longitudinally in front of the feeder former and one half superposed onto the other.

Anoter possibility lies in longitudinally cutting two webs of full width in front of the feeder formers 8, 9 and to send them, one behind the other, into the arrangement via both feeders, thereby producing 4 × 8 page signatures. The invention is however not restricted to the production of only these types of signatures but is versatile so as to permit many other types of signatures to be produced.

WHAT WE CLAIM IS:—

1. A multipurpose web folding and cutting arrangement for producing printed sheets or page sections (signatures) from a printed web, the arrangement comprising a feeder folding former for folding a continuous web longitudinally, a first transverse folding cylinder and a transverse cutting cylinder cooperating therewith, arranged to receive a longitudinally folded web from the folding former and adapted to cut the web transversely, the transverse cutting cylinder being adapted so that its cutting means can be rendered inoperative, the first folding cylinder having means on its periphery for transferring cut sheets or page sections around with it as it rotates, a second transverse folding cylinder arranged to receive sheets or page sections from the first folding cylinder, a further longitudinal folder for folding sheets or page sections longitudinally and arranged for receiving sheet or page sections from the second folding cylinder, and an additional cylinder which is provided with means on its periphery for transversely cutting a web and/or collecting

sheets and which is arranged for cooperation with the first folding cylinder.

2. An arrangement as claimed in claim 1, in which the additional cylinder is provided with three cutting knives circumferentially spaced apart by 120° around the periphery of the cylinder and three collector means equally circumferentially spaced.

3. An arrangement as claimed in claim 2, in which the three collector means on the additional cylinder comprise three equally circumferentially spaced rows of spikes.

4. An arrangement as claimed in claim 2 or claim 3, in which the axes of the cylinders are horizontal and in which the additional cylinder is disposed below the first folding cylinder.

5. An arrangement as claimed in any one of claims 1 to 4, in which the ratio of the diameter of the first folding cylinder to that of the additional cylinder is 4:3.

6. An arrangement as claimed in any one of the preceding claims, in which the first folding cylinder is provided with four equally circumferentially spaced cutting grooves adapted to cooperate with cutting knives on the adjacent cutting cylinders.

7. An arrangement as claimed in claim 6, in which two of the cutting grooves on the first folding cylinder, which lie diametrically opposite each other, each have a folding knife bar disposed adjacent thereto such that either the knife bars or the two cutting grooves may be operative.

8. An arrangement as claimed in claim 6, in which two of the cutting grooves on the first folding cylinder, which lie opposite each other, are each provided on a folding knife bar carried by the first folding cylinder.

9. An arrangement as claimed in any one of the preceding claims, in which the transferring means on the first folding cylinder comprises two sets of spikes arranged diametrically opposite each other.

10. An arrangement as claimed in any one of the preceding claims, in which the second folding cylinder is provided with two sets of spikes arranged diametrically opposite each other and two folding grippers arranged diametrically opposite each other and circumferentially spaced by 90° from the rows of spikes.

11. An arrangement as claimed in any one of the preceding claims, in which a longitudinal perforating device is provided for cooperation with the first folding cylinder at a location relative to the direction of rotation of the latter between the additional cylinder and the second folding cylinder.

12. An arrangement as claimed in claim 4, or in any claim appendant to claim 4, in which delivery means is provided for delivering sheets or page sections transferred to it directly from the additional cylinder.

13. An arrangement as claimed in any one of the preceding claims, in which the additional cylinder is mounted so as to rotate in a fixed location.

14. An arrangement as claimed in any one of claims 1 to 12, in which the additional cylinder is rotatably mounted and mounted so as to be bodily movable between an operative position adjacent the first folding cylinder and a non-operative position spaced from the first folding cylinder.

15. A web folding and cuitting arrangement substantially as specifically described herein with reference to the accompanying drawing.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1979.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

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1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

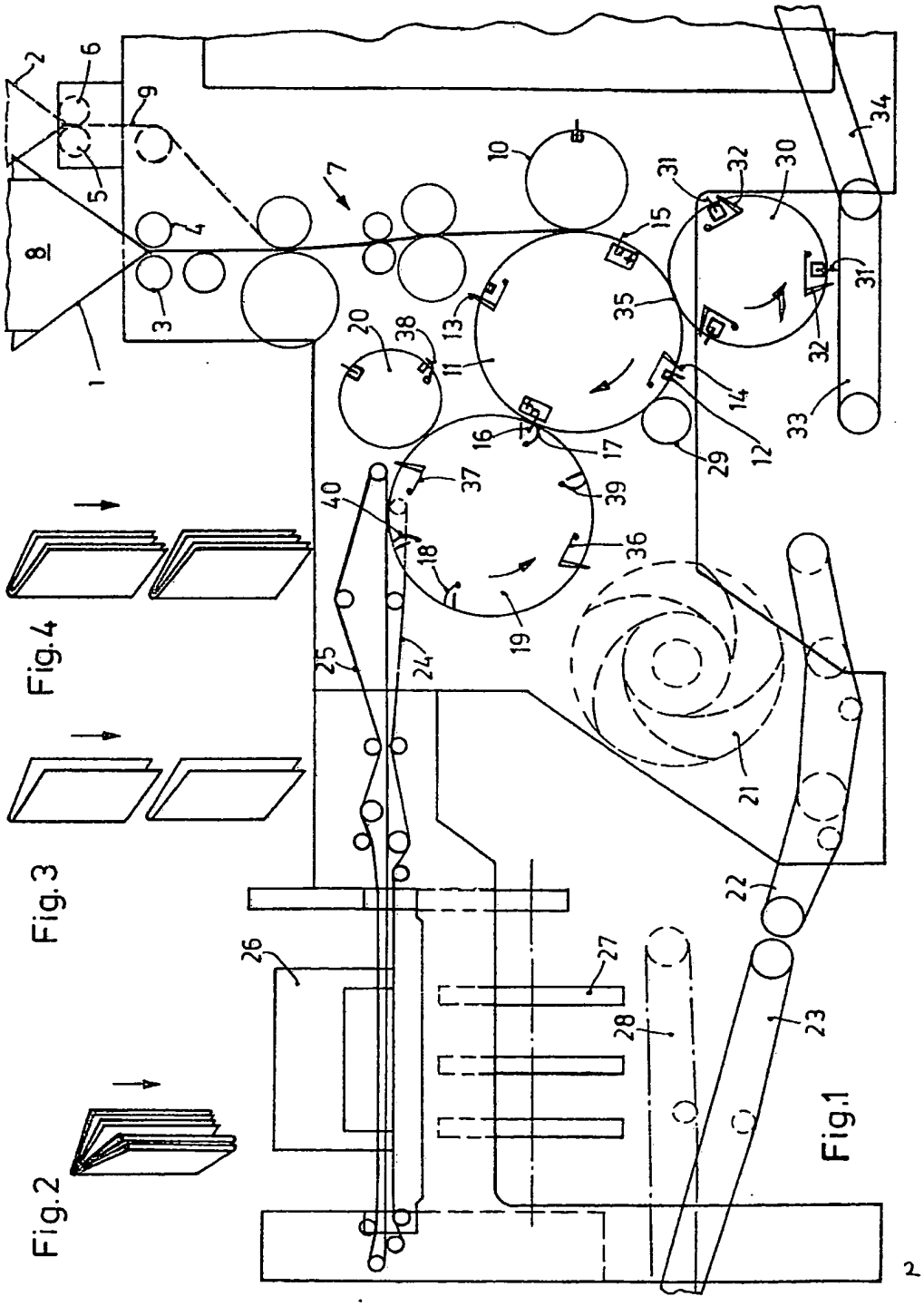

Fig.1

Fig.2

Fig.3

Fig.4